

**Patents and Publications**  
**Christopher L. Marshall**

**Patents and Inventions**

Process for In-Situ Production of Hydrogen ( $H_2$ ) by Alcohol Decomposition for Emission Reduction from Internal Combustion Engines

K. B. Anderson, K. Carrado Gregar, C. L. Marshall, and S. R. Segal  
U. S. Patent No. 6,668,763, December 30, 2003

Novel Catalyst for Selective NOx Reduction Using Hydrocarbons

C. L. Marshall and M. K. Neylon  
U.S. Patent Application No. 20030073566, April 17, 2003

Novel Catalyst for Selective NOx Reduction Using Hydrocarbons

C. L. Marshall and M. K. Neylon  
International Patent Application No. WO 03/031781 A1, April 17, 2003

Method for Encapsulating and Isolating Hazardous Cations, Medium for Encapsulating and Isolating Hazardous Cations

S. R. Wasserman, K. B. Anderson, K. Song, S. E. Yuchs, and C. L. Marshall  
U.S. Patent No. 5,743,842, April 28, 1998

Process for Upgrading Methanol to Higher Hydrocarbons

C. L. Marshall and J. T. Miller  
U.S. Patent No. 5,191,142, March 2, 1993

Hydrocracking Process

S. G. Kukes, C. L. Marshall, P. D. Hopkins, and A. L. Hensley, Jr.  
U.S. Patent No. 4,980,328, December 25, 1990

Hydrocracking Process

S. G. Kukes, C. L. Marshall, P. D. Hopkins, and A. L. Hensley, Jr.  
U.S. Patent No. 4,925,546, May 15, 1990

## Journal Articles and Book Chapters

Coated Bifunctional Catalysts for NO<sub>x</sub> SCR with C<sub>3</sub>H<sub>6</sub>, Part I: Water-Enhanced Activity

M. K. Neylon, M. J. Castagnola, N. B. Castagnola, and C. L. Marshall  
Catalysis Today **96**(1-2), 53-60 (2004)

Coated Bifunctional Catalysis for NO<sub>x</sub> SCR with C<sub>3</sub>H<sub>6</sub>, Part II: *In situ* Spectroscopic Characterization

M. J. Castagnola, M. K. Neylon, A. J. Kropf, and C. L. Marshall  
Catalysis Today **96**(1-2), 61-70 (2004)

X-Ray Absorption Studies of Catalyst Nanostructures

J. T. Miller, M. K. Neylon, C. L. Marshall, and A. J. Kropf  
Encyclopedia of Nanoscience and Nanotechnology, Ed. J. A. Schwarz et al., 3953-3972 (2004)

X-Ray Absorption Studies of Catalyst Nanostructures

J. T. Miller, M. K. Neylon, C. L. Marshall, and A. J. Kropf  
In: Encyclopedia of Nanoscience and Nanotechnology, Eds. J. A. Schwarz et al., Marcel Dekker, New York, NY, 3953-3972 (2004)

Gas Phase Oxidation of Benzoic Acid to Phenol over Nickel Oxide Catalysts

V. Duma, K. E. Popp, M. C. Kung, H. Zhou, S. Nguyen, S. Ohyama, H. H. Kung and C. L. Marshall  
Chemical Engineering Journal **99**(3), 227-236 (2004)

Studies of Cu-ZSM-5 by X-Ray Absorption Spectroscopy and Its Application for the Oxidation of Benzene to Phenol by Air

N. B. Castagnola, A. J. Kropf, and C. L. Marshall  
Applied Catalysis A: General, **290**, 110-122 (2005)

Sono Synthesis and Characterization of Nanophase Molybdenum-based Materials for Catalytic Hydrodesulfurization

D. Mahajan, C. L. Marshall, N. B. Castagnola, and J. C. Hanson  
Applied Catalysis A **258**(1), 83-91 (2004)

Lathlike Mesostructured  $\gamma$ -Alumina as a Hydrodesulfurization Catalyst Support

R. W. Hicks, N. B. Castagnola, Z. Zhang, T. J. Pinnavaia, and C. L. Marshall  
Applied Catalysis A: General, **254**(2), 311-317

Hydrogen Production by Direct Contact Pyrolysis of Natural Gas

M. Serban, M. A. Lewis, C. L. Marshall, and R. D. Doctor  
Energy & Fuels **17**(3), 705-713, May/June (2003)

Catalytic Decomposition of Alcohols, Including Ethanol, for In Situ H<sub>2</sub> Generation in a Fuel Stream Using a Layered Double Hydroxide-Derived Catalyst

S. R. Segal, K. A. Carrado, C. L. Marshall, and K. B. Anderson

Applied Catalysis A: General, **248**(1-2), 33-45 (2003)

Low Temperature Steam Reforming of Methanol over Layered Double Hydroxide-Derived Catalysts

S. R. Segal, K. B. Anderson, K. A. Carrado, and C. L. Marshall

Applied Catalysis A, General **231**, 215–226 (2002)

*In Situ* EXAFS Analysis of the Temperature Programmed Reduction of Cu-ZSM-5

M. K. Neylon, C. L. Marshall, and A. J. Kropf

Journal of the American Chemical Society **124**(19), 5457–5465 (2002)

(Co)MoS<sub>2</sub>/Alumina Hydrotreating Catalysts: An EXAFS Study of the Chemisorption and Partial Oxidation with O<sub>2</sub>

J. T. Miller, C. L. Marshall, and A. J. Kropf

Journal of Catalysis **202**, 89–99 (2001)

Selective Hydrodesulfurization of FCC Naptha with Supported MoS<sub>2</sub> Catalysts: The Role of Cobalt

J. T. Miller, W. J. Reagan, J. A. Kaduk, C. L. Marshall, and A. J. Kropf

Journal of Catalysis **193**(1), 123–131 (2000)

Mesoporous Synthetic Clays: Synthesis, Characterization, and Use as HDS Catalyst Supports

C. L. Marshall and D. Wei

Studies Surf. Sci. Catal. **129**, 417–424 (2000)

Materials Derived from Synthetic Organo-Clay Complexes as Novel Hydrodesulfurization Catalyst Supports

K. A. Carrado, C. L. Marshall, J. R. Brenner, and K. Song

Microporous Mesoporous Materials **20**, 17–26 (1998)

Microstructural Characterization of a Highly HDS-Active Co<sub>6</sub>S<sub>8</sub>-Pillared Molybdenum Sulfide

J. R. Brenner, C. L. Marshall, L. Ellis, N. A. Tomczyk, J. Heising, and M. Kanatzidis

Chemistry of Materials **10**(5), 1244–1257 (1998)

Structural Characterization of Rhodium-Containing Hydrodesulfurization (HDS) Catalysts Derived from a Laser Vaporization Cluster Source

J. R. Brenner, C. L. Marshall, G. Nieman, E. Parks, S. Riley, L. Ellis, N. Tomczyk, and R. Winans

Journal of Catalysis **166**(2), 294–305 (1997)

Review of Dimethyl Carbonate (DMC) Manufacture and Its Characteristics as a Fuel Additive  
C. L. Marshall and M. A. Pacheco  
*Energy & Fuels* **11**(1), 2–29 (1997)

Synthesis of Nanoscale Transition Metal Particles Through the Use of Microwave Plasmas  
J. R. Brenner, J. B. L. Harkness, M. B. Knickelbein, G. K. Krumdick, and C. L. Marshall  
*Nanostructured Materials* **8**(1), 1–17 (1997)

*Ab Initio* Molecular Orbital Study of the Acidity of Hydrated Lithium Hydroxide  
C. L. Marshall, J. Nicholas, K. A. Carrado, H. V. Brand, and R. E. Winans  
*Journal of Physical Chemistry* **100**(39), 15748–15752 (1996)

Separation and Characterization of FCC Catalysts Using Density Gradient Separation  
G. R. Dyrkacz, C. L. Marshall, L. Ruscic, and W. J. Reagan  
*Energy & Fuels* **10**(3), 849–854 (1996)

Molecular Modeling Issues in the Petroleum Industry  
C. L. Marshall  
*Chemical Design Automation News* **7**, 2–4 (1992)

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation  
R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, B. L. Meyers, J. B. Hall, and  
B. J. Huggins  
*ACS Symposium Series on Fluid Catalytic Cracking* **2** **452**, 109–143 (1991)

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation  
R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, B. L. Meyers, J. B. Hall, and B. J.  
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*Preprints of the American Chemical Society, Division of Petroleum Chemistry* **35**,  
694–718 (1990)

X-Ray Absorption Study of Vanadium on Regenerated Catalytic Cracking Catalysts  
D. J. Sajkowski, S. A. Roth, L. E. Iton, B. L. Meyers, C. L. Marshall, T. H. Fleisch, and  
W. N. Delgass  
*Applied Catalysis* **51**, 255–262 (1989)

Hexane Cracking on Clean Zeolite Surfaces  
P. D. Hopkins, C. L. Marshall, J. T. Miller, and L. B. Raska  
*Studies in Surface Science and Catalysis* 1987, **38**, 281–293 (1988)

Metals Contamination of Aluminosilicate Cracking Catalysts by Nickel- and Vanadyl-  
Tetraphenylporphin  
S. A. Roth, L. E. Iton, T. H. Fleisch, B. L. Meyers, C. L. Marshall, and W. N. Delgass  
*Journal of Catalysis* **108**, 214–232 (1987)

Silicon-29 and Aluminum-27 NMR Study of Steamed Faujasites: Evidence for Non-Framework Tetrahedrally Bound Aluminum

G. J. Ray, B. L. Meyers, and C. L. Marshall  
Zeolites **7**, 307-310 (1987)

Hydrothermal Dealumination of Faujasites

T. H. Fleisch, B. L. Meyers, G. J. Ray, J. B. Hall, and C. L. Marshall  
Journal of Catalysis **99**, 117-125 (1986)

Dealumination and Aluminum Ion Migration in Faujasites

B. L. Meyers, T. H. Fleisch, and C. L. Marshall  
Applied Surface Science **26**, 503-516 (1986)

Structure-Directing Properties of Sodium (+) Ion in the Solution Ordering of Guanosine 5'-Monophosphate. Stoichiometry of Aggregation, Binding to Ethidium, and Modes of Sodium (+) Ion Complexation

E. Bouhoutsos-Brown, C. L. Marshall, and T. J. Pinnavaia  
Journal of the American Chemical Society, **104**, 6576-6584 (1982)

Alkali Metal Ion Specificity in the Solution Ordering of a Nucleotide, 5'-Guanosine Monophosphate

T. J. Pinnavaia, C. L. Marshall, C. M. Mettler, C. L. Fisk, H. T. Miles, and E. D. Becker  
Journal of the American Chemical Society **100**, 3625-2637 (1978)

## Reports and Report Sections

Selective Catalytic Reduction of NO<sub>x</sub> with Hydrocarbon Fuels as Reductants

M. J. Castagnola, C. L. Marshall, and A. J. Kropf  
In: Advanced Photon Source Activity Report, ANL-04/16, Argonne National Laboratory, Argonne, IL, December (2004)

In Situ EXAFS Characterization of New Types of Sn-Pt/SiO<sub>2</sub> Catalysts

M. K. Neylon, C. L. Marshall, and A. J. Kropf  
In ANL/02-06, Advanced Photon Source Activity Report, Argonne National Laboratory, Argonne, IL, December (2002)

*In Situ* XAFS Analysis of the Reduction and Oxidation Properties of Cu-ZSM-5

M. K. Neylon, C. L. Marshall, and A. J. Kropf  
In *Advanced Photon Source Activity Report 2001*, ANL-02/06 (2002)

EXAFS Characterization of New Types of Sn-Pt/SiO<sub>2</sub> Catalysts

C. L. Marshall, A. J. Kropf, and J. L. Margitfalvi  
In *Advanced Photon Source Activity Report 2001*, ANL-02/06, Argonne National Laboratory, Argonne, IL (2002)

(Co)MoS<sub>2</sub>/Alumina Hydrotreating Catalysts: An EXAFS Study of the Chemisorption and Partial Oxidation with O<sub>2</sub>

J. T. Miller, C. L. Marshall, and A. J. Kropf

In *Advanced Photon Source Activity Report 2000*, ANL-01/03 (2001)

**Abstracts and Proceedings Papers**

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

M. K. Neylon, M. J. Castagnola, A. J. Kropf, and C. L. Marshall

Proceedings of American Society of Mechanical Engineers Internal Combustion Engine Division 2004 Fall Technical Conference, Long Beach, CA, October 24-27, 2004, Paper ICEF2004-902 (2004)

Hydrogen Cycle Employing Calcium-Bromine and Electrolysis

R. D. Doctor, C. L. Marshall, and D. C. Wade

Abstracts of Papers of the American Chemical Society 224:U579, 142-Fuel, Part 1, American Chemical Society (2002)

Low Temperature Steam Reforming of Methanol over Layered Double Hydroxide-Derived Catalysts

S. R. Segal, K. B. Anderson, K. A. Carrado, and C. L. Marshall

Preprints of the Fuel Division of the American Chemical Society, **46**(2), 654-656 (2001)

Mesoporous Synthetic Clays: Synthesis, Characterization, and Use as HDS Catalyst Supports

K. A. Carrado, L. Xu, S. Seifer, C. L. Marshall, and D. Wei

Access in Nanoporous Materials II Symposium, Banff, Canada, May 25-28, 2000, Studies in Surface Science and Catalysis, Eds. A. Sayari, et al., **129**, 417-24, Elsevier Science (2000)

The Pyrolysis of Methane over Liquid Metal to Form Hydrogen and Carbon

C. L. Marshall, M. A. Lewis, L. Leibowitz, and D. Lewis

Proceedings of the First Information Meeting on Nuclear Production of Hydrogen, Paris, France, October 2-3, 2000, pp. 137-145 (2000)

Total Fuel Cycle Impacts of Advanced Vehicles

F. Stodolsky, L. Gaines, C. L. Marshall, F. An and J. J. Eberhardt

Proceedings of 1999 SAE International Congress & Exposition, Detroit, MI, March 1-4, 1999, Paper No. 1999-01-0322, Society of Automotive Engineers, Warrendale, PA (1999) (*Winner, Arch T. Colwell Merit Award in recognition of an outstanding contribution to the SAE literature which advances the technology of self-propelled vehicles, thereby advancing the objectives of SAE*)

Catalytic Partial Oxidation Reforming of Hydrocarbon Fuels

S. Ahmed, M. Krumpelt, R. Kumar, S. H. D. Lee, J. D. Carter, R. Wilkenhoener, and C. L. Marshall

Abstracts, Fuel Cell Seminar, Palm Springs, CA, November 16–19, 1998,  
pp. 242–245 (1998)

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation

R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, B. L. Meyers, J. B. Hall, and B. J. Huggins

Preprints of the American Institute of Chemical Engineers 1989 Annual Meeting,  
Symposium on "Recent Advances in Fluid Catalytic Cracking," Paper 91D (1989)

**Papers Presented at Scientific Meetings**

Catalysis in the "Hydrogen Economy" -- Needs for Both Fundamental and Applied Research

C. L. Marshall

Korean Electric Power Corporation (KEPCO), Daejon, Korea, October 18, 2004

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

C. L. Marshall, M. K. Neylon, M. J. Castagnola, and A. J. Kropf  
SK Corporation, Daejon, Korea, October 19, 2004

Desulfurization of Gasoline, Distillate, and Heavy Feeds to Meet the Environmental Needs of the 21st Century

C. L. Marshall, D. Wei, and K. A. Carrado

Korean Research Institute of Chemical Technology (KRICT), October 19, 2004

Catalysis in the "Hydrogen Economy" -- Needs for Both Fundamental and Applied Research

C. L. Marshall

Korean Institute of Energy Research (KEIR), October 20, 2004

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

C. L. Marshall, M. K. Neylon, M. J. Castagnola, and A. J. Kropf  
Annual Peer Review Meeting, Argonne National Laboratory, Argonne, IL, May 18, 2004

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

C. L. Marshall, M. K. Neylon, M. J. Castagnola, and A. J. Kropf

Presented at 28th International Cocoa Beach Conference and Exposition on Advanced Ceramics & Composites, Cocoa Beach, FL, January 25-30, 2004

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

C. L. Marshall, M. K. Neylon, M. J. Castagnola, and A. J. Kropf

Presented at Catalysts for Emissions Control from Natural Gas Engines, DOE Distributed Energy and Electric Reliability Program, Argonne, IL, November 5-6, 2003

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

M. K. Neylon, M. J. Castagnola, A. J. Kropf, and C. L. Marshall

DOE/EERE FreedomCAR and Vehicle Technologies 9th Diesel Emissions Reduction Conference, Newport, RI, August 24-28, 2003

Sono-Synthesis and Characterization of Nanophase Hydrodesulfurization Catalysts

C. L. Marshall, D. Mahajan, A. J. Kropf, M. Serban, N. B. Castagnola, and J. C. Hanson  
226th Meeting of the American Chemical Society, New York, NY, September 7-11, 2003

DeNOx Properties of Vanadium Oxide Based Catalysts

I. M. Khan, S. Tabussum, and C. L. Marshall

11th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis, Northwestern University, Evanston, IL, July 22, 2003

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

C. L. Marshall, M. K. Neylon, M. J. Castagnola, and A. J. Kropf

11th International Symposium on Relations between Homogeneous and Heterogeneous Catalysis, Northwestern University, Evanston, IL, July 22, 2003

Desulphurization of Gasoline, Distillate, and Heavy Feeds to Meet the Environmental Needs of the 21<sup>st</sup> Century

C. L. Marshall

18<sup>th</sup> North American Catalysis Society Meeting, Cancun, Mexico, June 1–6, 2003

In Situ Spectroscopic Characterization for Identification of Active Species in a Novel Bifunctional Selective Catalytic Reduction Catalyst

M. J. Castagnola, M. K. Neylon, A. J. Kropf, and C. L. Marshall

North American Catalysis Society 18<sup>th</sup> Annual Meeting, Cancun, Mexico, June 1–6, 2003

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North American Catalysis Society 18<sup>th</sup> Annual Meeting, Cancun, Mexico, June 1–6, 2003

Cage Protected Fischer-Tropsch Catalyst for Improved Mechanical Stability

M. J. Castagnola, D. C. Cronauer, and C. L. Marshall

U.S. Department of Energy Review of Argonne National Laboratory Electron Microscopy Center, June 3, 2003

Bifunctional Catalysts for the Selective Catalytic Reduction of NO by Hydrocarbons

M. K. Neylon, M. J. Castagnola, A. J. Kropf, and C. L. Marshall

Presented at 2003 Spring Symposium of Catalysis Club of Chicago, Evanston, IL,  
May 20, 2003

In-Situ Spectroscopic Characterization for Identification of Active Species in a Novel  
Bifunctional Selective Catalytic Reduction Catalyst

M. J. Castagnola, M. K. Neylon, A. J. Kropf, and C. L. Marshall

The Catalysis Club of Chicago Spring Symposium, Northwestern University,  
Evanston, IL, May 20, 2003

Hydrogen Production by Direct Contact Pyrolysis of Natural Gas

M. Serban, M. A. Lewis, C. L. Marshall, and R. D. Doctor

224<sup>th</sup> American Chemical Society National Meeting, Boston, MA, August 18–22,  
2002

Low Temperature Steam Reforming of Methanol over Layered double Hydroxides

S. R. Segal, K. B. Anderson, K. A. Carrado, and C. L. Marshall

Gordon Conference on Catalysis, New London, NH, June 25, 2002

New Supports for the Catalytic Removal of Sulfur from Heavy Oils

C. L. Marshall, L. Ruscic, and D. Wei

Gordon Conference on Catalysis, New London, NH, June 23-28, 2002

In Situ EXAFS Characterization of the Reduction of Cu-ZSM-5

M. K. Neylon, C. L. Marshall, and A. J. Kropf

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Redox Properties of Cu-ZSM-5 Determined by *In Situ* XAFS Analysis

M. K. Neylon, C. L. Marshall, and A. J. Kropf

Spring Symposium of the Catalysis Club of Chicago, May 20, 2002,  
Northwestern University, Evanston, IL

Redox Properties of Cu-ZSM-5 Determined by *In Situ* XAFS Analysis

M. K. Neylon, C. L. Marshall, and A. J. Kropf

3<sup>rd</sup> DOE National Laboratory Catalysis Conference, May 22-23, 2002, Richland,  
WA

Gas Phase Hydroxylation of Benzoic Acid to Phenol

V. Duma, K. Popp, M. C. Kung, S. Ohya, H. H. Kung, and C. L. Marshall

American Chemical Society Meeting, Division of Industrial and Engineering  
Chemistry "Green Chemistry", Orlando, FL, April 7–11, 2002

An Investigation on the Catalytic Behavior of Modified Mesoporous Catalyst Supports for Hydrodesulfurization

C. L. Marshall

Illinois Institute of Technology, Chemistry Department, Chicago, IL, September 19, 2001

*In Situ* EXAFS Characterization of the Reduction of Cu-ZSM-5

M. K. Neylon, C. L. Marshall, and A. J. Kropf

Presented at the 11<sup>th</sup> Users Meeting for the Advanced Photon Source, Argonne National Laboratory, Argonne, IL, October 9–11, 2001

Heterogeneous Catalysis: Trends and Needs for Computational Sciences

C. L. Marshall

Accelerating Industrial R&D with Predictive Simulations of Reaction Mechanisms and Materials Properties, Accelrys Workshop, Chicago, IL, August 21, 2001

A Combinational Method for the Fast Screening of Catalysts for the Oxidation of Benzene to Phenol

E. A. Gardner, C. L. Marshall, L. Iton, C. Hamilton, S. Alerasook, P. E. Mayurik, M. Neurock, P. C. Y. Yeh, F. M Dautzenberg, R. Overbeek, D. H. Klipstein, and G. McRae

Presented at the 17<sup>th</sup> Meeting of the North American Catalysis Soc., the Westin Harbour Castle, Toronto, Ontario, Canada, June 3–8, 2001

Heterogeneous Catalysts for Selective Oxidation

E. A. Gardner, C. L. Marshall, L. Iton, and T. J. Pinnavaia

Presented at the University of Texas at El Paso, El Paso, TX, June 26, 2001

(Co)MoS<sub>2</sub>/Alumina Hydrotreating Catalysts: An EXAFS Study of the Chemisorption and Partial Oxidation with O<sub>2</sub>

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17th North American Catalysis Society Meeting, Toronto, Ontario, Canada, June 3-8, 2001

EXAFS Characterization of New Types of Sn-Pt/SiO<sub>2</sub> Catalysts

A. J. Kropf, C. L. Marshall, J. L. Margitfalvi, I. Borbath, and J. T. Miller

17th North American Catalysis Society Meeting, Toronto, Ontario, Canada, June 3-8, 2001

An Investigation on the Catalytic Behavior of Modified Mesoporous Catalysts for Hydrodesulfurization

D. Wei, K. A. Carrado, L. Ruscic, and C. L. Marshall

17th North American Catalysis Society Meeting, Toronto, Ontario, Canada, June 3-8, 2001

New Bifunctional Catalysts of Selective Catalytic Reduction of NO

M. K. Neylon, C. L. Marshall, L. C. Satek, and M. E. Carrera

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Presented at the 2001 Spring Symp., BP Research and Technology Conf. Center, Naperville, IL, May 22, 2001

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S. R. Segal, K. B. Anderson, K. A. Carrado, and C. L. Marshall

Presented at the Catalysis Club of Chicago Meeting, Naperville, IL, May 22, 2001

A Combinatorial Method for the Fast Screening of Catalysts for the Oxidation of Benzene to Phenol

E. Gardner, L. Iton, C. Hamilton, and C. L. Marshall

Spring Symposium of the Catalysis Club of Chicago, May 9, 2001

Low Temperature Steam Reforming of Methanol over Layered Double Hydroxides

S. R. Segal, K. B. Anderson, K. A. Carrado, and C. L. Marshall

Spring Symposium of the Catalysis Club of Chicago, May 9, 2001

Bifunctional Catalysts for Selective Catalytic Reduction of NO<sub>x</sub>

M. K. Neylon, C. L. Marshall, L. C. Satek, M. E. Carrera

Presented at the ACS Spring Symp., San Diego, CA, April 1-5, 2001

Combinatorial Screening for the Direct Catalytic Oxidation of Benzene to Phenol

C. Hamilton, E. A. Gardner, C. L. Marshall, L. Iton

American Chemical Society Spring Symposium, April 1-5, 2001

Developing Catalytic Reformers for Use in Fuel Cells

C. L. Marshall

Presented at the MSI Workshop on New Technologies: Accelerate the R&D of Fuel Cell and Battery Technologies, Windsor, CT, March 1, 2001

Hydrodesulfurization Activity and Selectivity of MCM-41 Supported Catalysts

C. L. Marshall

California Institute of Technology, Pasadena, CA, February 9, 2001

Hydrodesulfurization Activity and Selectivity of MCM-41 Supported Catalysts

C. L. Marshall

Lawrence Berkeley National Laboratory, Berkeley, CA, February 8, 2001

Hydrodesulfurization Activity and Selectivity of MCM-41 Supported Catalysts

C. L. Marshall

Pacific Northwest National Laboratory, Richland, WA, February 6, 2001

New Catalyst Technology for the Direct Oxidation of Benzene to Phenol

C. Hamilton, E. A. Gardner, L. Iton, C. L. Marshall, S. Alerasool, P.E. Mayurinik, P. C. Y. Yeh, F. M. Dautzenberg, R. Overbeek, G. McRae, E. Meeks, M. Neurock, H. H. Kung, and K. Popp

Presented at the National Laboratory Catalysis Research Conf. Argonne National Laboratory, Argonne, IL, October 12–13, 2000

The Role of Cobalt in (Co)MoS<sub>2</sub> Hydrodesulfurization Catalysts

A. J. Kropf and C. L. Marshall

Presented at the National Laboratory Catalysis Conf., Argonne National Laboratory, Argonne, IL, Naperville, IL, October 12–13, 2000

Nanophase Support Materials as Catalysts for Ultra-Deep Sulfur Removal from Crude Oil and Transportation Fuels

D. Mahajan and C. L. Marshall

Presented at the National Laboratory Catalysis Research Conf., Argonne National Laboratory, Argonne, IL, October 12–13, 2000

Hydrodesulfurization Activity and Selectivity of MCM-41 Supported Catalysts

C. L. Marshall, D. Wei, L. Ruscic, L. Xu, and K. A. Carrado

Presented at the National Laboratory Catalysis Research Conf., Argonne National Laboratory, Argonne, IL, October 12–13, 2000

Bifunctional Catalysts for Selective NO<sub>x</sub> Reduction

M. K. Neylon and C. L. Marshall

Presented at the 2000 National Laboratory Catalysis Research Conference, Argonne National Laboratory, Argonne, IL, October 12–13, 2000

Combinational Catalyst Testing

C. L. Marshall

Presented at the Great Lakes Chinese Chemical Society Meeting, Arlington Heights, IL, August 19, 2000

Catalysis Research at Argonne National Laboratory

C. L. Marshall

Presented at the C1 Upgrading Meeting, Hedgesville, WV, August 1, 2000

Effect of Aluminum Loading on the Activity and Selectivity of Heavy Oil Desulfurization Catalysts

C. Marshall, K. A. Carrado, D. Wei, L. Xu, and L. Ruscic

International Symposium on Meoporous Molecular Sieves, Quebec City, Quebec, August 29, 2000

Combinatorial Catalyst Testing

C. Marshall

Great Lakes Chinese Chemical Society Meeting, Arlington Heights, IL, August 19, 2000

New Supports for the Desulfurization of Diesel and Heavy Oils

C. L. Marshall, L. Ruscic, D. Wei, L. Xu, K. A. Carradao, and D. Banerjee

Presented at the National Petroleum Technology Office Program Review, Denver, CO, June 29, 2000

EXAFS of (Co)MoS<sub>2</sub> Hydrodesulfurization Catalysts

A. J. Kropf, C. L. Marshall, J. T. Miller, and K. A. Kunz

Presented at the Catalysis Club of Chicago, Chicago, IL, May 11, 2000

*Ab Initio* Investigation of the Hydrodesulfurization Process

C. L. Marshall, J. R. Brenner, J. L. Tilson, M. Palmer, and A. Dutoi

Presented at the Catalysis Club of Chicago, Chicago, IL, May 11, 2000

Difference Analysis of the EXAFS of (Co)MoS<sub>2</sub> Hydrodesulfurization Catalysts

A. J. Kropf, C. L. Marshall and J. T. Miller

2000 Spring Symposium of the Catalysis Club of Chicago, May 11, 2000

Difference Analysis of the EXAFS of (Co)MoS<sub>2</sub> Hydrosulfurization Catalysts

A. J. Kropf, C. L. Marshall, D. Wei, J. T. Miller, and K. Kunz

Tenth Users Meeting for the Advanced Photon Source, Argonne National Laboratory, Argonne, IL, May 2–4, 2000

New Mesoporous Supports for the Desulfurization of Diesel and Heavy Oils

C. L. Marshall

American Chemical Society, Chicago Section, Chicago, IL, February 25, 2000

High Throughput Screening of Heterogeneous Catalysts in the Fuel Reforming Area

C. L. Marshall

Engineered Catalysts Meeting, New Orleans, LA, December 9, 1999

New Mesoporous Supports for the Desulfurization of Diesel and Heavy Oils

C. L. Marshall

DOE Fossil Energy Review Meeting, Cincinnati, OH, September 22, 1999

New Catalyst Technology for the Selective Oxidation of Feedstock Aromatic Compounds to Commodity Chemicals

E. A. Gardner, C. L. Marshall, L. E. Iton, H. H. Kung, K. Popp, F. Sherif, R. Rao, Z. C. Zhang, and G. Whitwell

218th American Chemical Society National Meeting, New Orleans, LA, August 22–26, 1999

Catalytic Partial Oxidation Reforming Materials and Processes

M. Krumpelt, S. Ahmed, R. Wilkenhoener, J. D. Carter, and C. L. Marshall

Presented at the Annual National Laboratory R&D Meeting of the DOE Fuel Cells for Transportation Program, Argonne, IL, July 23–25, 1999

Effect of Aluminum Concentration on Hydrodesulfurization Activity and Selectivity of MCM-41 Supported Catalysts

D. Wei, L. Xu, K. A. Carrado, and C. L. Marshall

16th North American Catalysis Society Meeting, Boston, MA, May 30–June 4, 1999

Hydrodesulfurization of Heavy Oil Utilizing Polymer Tailored Mesoporous Clays as Catalyst Supports

D. Wei, K. A. Carrado, L. Xu, Y. Shi and C. L. Marshall

Presented at the 16th North American Catalysis Soc. Meeting, Boston, MA, May 30–June 4, 1999

Catalytic Conversion of Waste Materials and Coals to Transportation Fuels

Y. Shi, C. L. Marshall, and E. M. Eyring

Presented at the Gordon Research Conf., New London, NH, June 20–25, 1999

Fundamental Understanding of Autothermal Reforming Catalysts

C. L. Marshall

DOE Fuel Cell Review, Argonne, IL, June 24, 1999

Computational Chemistry Integration into Hydrodesulfurization Catalysis Research

C. L. Marshall, J. L. Tilson, A. D. Dutoi, and J. R. Brenner

Presented at the Divisional Colloid Chemistry Meeting, Am. Chem. Soc. Annual Meeting, Anaheim, CA, March 21–25, 1999

Ab Initio Investigation of the Hydrodesulfurization Process

C. L. Marshall, J. R. Brenner, J. L. Tilson, M. Palmer, and A. Dutoi

217th Meeting of the American Chemical Society, Anaheim, CA, March 21–25, 1999

Improved Catalysts for the Removal of Sulfur from Heavy Hydrocarbons

C. L. Marshall, D. Wei, and J. R. Brenner

DOE National Laboratory Catalysis Research Symposium, Albuquerque, NM,  
February 24–25, 1999

Improved Catalysts for the Removal of Sulfur from Heavy Hydrocarbons

C. L. Marshall

Presented at the University of Illinois at Chicago, Department of Chemical  
Engineering, Chicago, IL, November 13, 1998

Improved Catalysts for the Removal of Sulfur from Heavy Hydrocarbons

C. L. Marshall

Presented at Dartmouth College, Dartmouth, NH, November 5, 1998

Improved Catalysts for the Removal of Sulfur from Heavy Hydrocarbons

C. L. Marshall

Chemical Technology Division Seminar Series, Argonne National Laboratory,  
Argonne, IL, August 31, 1998

Partial Oxidation Reformer Development

M. Krumpelt, S. Ahmed, R. Kumar, S. H. D. Lee, J. D. Carter, R. Wilkenhoener, and  
C. L. Marshall

Presented at the Annual National Laboratory R&D Meeting of the DOE Fuel  
Cells for Transportation Program, Los Alamos, NM, July 28–29, 1998

*Ab Initio* Calculations of the Hydrodesulfurization Process

C. L. Marshall, J. R. Brenner, J. L. Tilson, S. Harris, and M. R. Palmer

Presented at the Gordon Research Conf. on Catalysis, New London, NH, June 22,  
1998

*Ab Initio* Calculations of the Hydrodesulfurization Process

C. L. Marshall, J. R. Brenner, J. L. Tilson, and M. R. Palmer

Presented at the 215th Am. Chem. Soc. National Meeting, Dallas, TX, March 29–  
April 2, 1998

*Ab Initio* Calculations of Hydrodesulfurization Chemistry

C. L. Marshall, J. R. Brenner, J. L. Tilson, and M. R. Palmer

Presented at the Albemarle Chemicals Meeting, Baton Rouge, LA, December 11,  
1997

Structural Effects of the Addition of Late Transition State Metals to Molybdenum Sulfides

J. R. Brenner, C. L. Marshall, J. Heising, and M. Kanatzidis

Presented at the 15th North American Catalysis Soc. Meeting, Chicago, IL, May  
18–23, 1997

Understanding the Aging of Fluidized Cracking Catalysts Through the Use of Density Gradient Separation Techniques

C. L. Marshall, G. R. Dyrkacz, L. Ruscic, I. Vasalos, and W. J. Reagan

Presented at the 15th North American Catalysis Soc. Meeting, Chicago, IL, May 18–23, 1997

*Ab Initio* Calculations of the Hydrodesulfurization Process

C. L. Marshall, J. R. Brenner, J. L. Tilson, and M. R. Palmer

Presented at the 15th Meeting of the North American Catalysis Soc., Chicago, IL, May 18–23, 1997

*Ab Initio* Investigation of HDS Catalysts

C. L. Marshall, J. L. Tilson, M. R. Palmer, and J. R. Brenner

Presented at the 213th Am. Chem. Soc. National Meeting on Applications of Quantum Chemical and Molecular Simulation to Heterogeneous Catalysis, Division of Petroleum Chemistry, San Francisco, CA, April 13–17, 1997

The Use of High Performance Computers to Solve Problems in Catalytic Chemistry

J. L. Tilson and C. L. Marshall

Presented at the 213th Am. Chem. Soc. National Meeting on Industrial Applications of Computational Chemistry, Division of Computers in Chemistry, San Francisco, CA, April 13–17, 1997

All Electron *Ab Initio* Investigations of HDS Catalysis Energetics

C. L. Marshall, J. L. Tilson, M. R. Palmer, and J. R. Brenner

Presented at the Annual AIChE Meeting, Chicago, IL, November 10–15, 1996

Microstructural Characterization of an HDS-Active Co<sub>6</sub>S<sub>8</sub>-Pillared Molybdenum Sulfide

J. R. Brenner, C. L. Marshall, R. E. Winans, L. Ellis, N. A. Tomczyk, J. Heising, R. Bissessur, and M. Kanatzidis

Presented at the Annual AIChE Meeting, Chicago, IL, November 10–15, 1996

Understanding the Aging of Fluidized Cracking Catalysts Through the Use of Density Gradient Separation Techniques

C. L. Marshall, G. R. Dyrkacz, L. Ruscic, I. Vasalos, and W. J. Reagan

Presented at the Eleventh Int. Congress on Catalysis, Baltimore, MD, June 30, 1996

Structural Characterization of Rhodium-Containing Hydrodesulfurization (HDS) Catalysts Derived from a Laser Vaporization Cluster Source

J. R. Brenner, E. Parks, S. Riley, G. Nieman, J. L. Tilson, C. L. Marshall, and R. E. Winans

Presented at the Eleventh Int. Congress on Catalysis, Baltimore, MD, June 30, 1996

Synthesis of Nanoscale Transition Metal Particles Through the Use of Microwave Plasmas

J. R. Brenner, G. Krumdick, J. Harkness, M. Knickelbein, R. E. Winans, and  
C. L. Marshall

Presented at the Eleventh Int. Congress on Catalysis, Baltimore, MD, June 30,  
1996

Structural Characterization of Rhodium-Containing Hydrodesulfurization (HDS) Catalysts  
Derived from a Laser Vaporization Cluster Source

J. R. Brenner, E. Parks, S. Riley, G. Nieman, J. L. Tilson, C. L. Marshall, and  
R. E. Winans

Presented at the Catalysis Club of Chicago Spring Symp., Argonne, IL, May 7,  
1996

Separation and Characterization of FCC Catalysts Using Density Gradient Separation

C. L. Marshall, G. R. Dyrkacz, L. Ruscic, and W. J. Reagan

Presented at the 14th North American Catalysis Soc. Meeting, Snowbird, UT,  
June 14, 1995

Hydrodesulfurization of Heavy California Crude Oil

C. L. Marshall and J. R. Brenner

Presented at the 14th North American Catalysis Soc. Meeting, Snowbird, UT,  
June 12, 1995

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation

R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, and B. L. Meyers

Presented at Argonne National Laboratory, Chemistry Division, Argonne, IL,  
October 8, 1994

Hydration and Acidity of Alkali Cations I: Lithium

C. L. Marshall, J. Nicholas, K. A. Carrado, H. V. Brand, and R. E. Winans

Presented at the Gordon Research Conf. on Catalysis, June 1994

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation

R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, and B. L. Meyers

Presented at Argonne National Laboratory, Energy Systems Division, Argonne,  
IL, January 19, 1994

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

Arco Chemical Company, Newton Square, PA, June 3, 1993

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

National Institute of Standards and Testing, March 17, 1993

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

Fourth Chemical Conference on Chemical Reaction Engineering: Reaction Engineering--Its Core Components, Palm Coast, FL, February 23-25, 1993

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation

R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, and B. L. Meyers

California Institute of Technology, Pasadena, CA, February 4, 1992

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation

R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, and B. L. Meyers

Michigan State University, Lansing, MI, October 11, 1991

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

Michigan Catalysis Society Meeting, December 4, 1990

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

Michigan State University, Lansing, MI, October 8, 1990

Zeolites: Synthesis, Chemistry, and Catalysis

C. L. Marshall

Michigan State University, Lansing, MI, October 8, 1990

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

University of Michigan, Ann Arbor, MI, September 20, 1990

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

University of Delaware, Newark, DE, March 13, 1990

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

Union Carbide, Bound Brook, NJ, February 27, 1990

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

Special Topics in Molecular Sieve Synthesis-Structure-Simulation, Argonne National Laboratory, Argonne, IL, June 14-15, 1989

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall

Pittsburgh-Cleveland Catalysis Society Meeting, November 28, 1989

Electron Energy Loss Studies--Applications to Zeolites

G. W. Zajac, B. L. Meyers, J. B. Hall, R. A. Beyerlein, C. L. Marshall and J. T. Miller  
FACSS-89, October 2-6, 1989

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall  
Rice University, Houston, TX, September 28, 1989

Modeling of Zeolite Catalyst Surfaces

C. L. Marshall  
Gordon Research Conference on Catalysis, June 19-23, 1989

Monitoring Fluid Cracking Catalyst Deactivation Profile by Equilibrium Catalyst Separation

R. A. Beyerlein, G. A. Tamborski, C. L. Marshall, and B. L. Meyers  
Spring Symposium of the Catalysis Club of Chicago, Chicago, IL, May 15, 1989

Electron Energy Loss Studies--Applications to Zeolites

G. W. Zajac, B. L. Meyers, J. B. Hall, R. A. Beyerlein, C. L. Marshall, and J. T. Miller  
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An EXAFS Study of Vanadium on Catalytic Cracking Catalysts

D. J. Sajkowski, B. L. Meyers, C. L. Marshall, S. A. Roth, L. E. Iton, and W. N. Delgass  
11th Meeting of the North American Catalysis Society, Detroit, MI, May 1989

Computerized Molecular Modeling in Zeolite Catalysis

C. L. Marshall  
Purdue University, West Lafayette, IN, September 12, 1988

Computerized Molecular Modeling in Zeolite Catalysts

C. L. Marshall  
Northwestern University, Evanston, IL, April 20, 1988

Computerized Molecular Modeling in Zeolite Catalysts

C. L. Marshall  
Michigan State University, Lansing, MI, January 13, 1988

Uses of Computerized Molecular Modeling in Zeolite Catalysis

C. L. Marshall  
Illinois State University, Normal, IL, October 23, 1987

Molecular Structure and Solubility Properties of Asphaltenes

K. K. Robinson, C. L. Marshall, and F. S. Lee  
Amoco/University Poster Session, Naperville, IL, October 8, 1987

Hexane Cracking of Clean Zeolite Surfaces

P. D. Hopkins, C. L. Marshall, J. T. Miller, and L. B. Raska

North American Catalysis Society Meeting, San Diego, CA, May 18, 1987

Productivity Improvements Through the Use of Computerized Molecular Modeling

C. L. Marshall

IRI Advanced Study Group on "Effective Use of Computers in R&D," St. Petersburg, FL, March 4, 1987

Uses of Computerized Molecular Modeling in Zeolite Catalysis

C. L. Marshall

Catalysis Club of Chicago Monthly Meeting, Chicago, IL, December 8, 1986

Dealumination and Aluminum Ion Migration in Faujasites

B. L. Meyers, T. H. Fleisch, and C. L. Marshall

Catalysis Club of Chicago Spring Symposium, Chicago, IL, May 12, 1986

Sodium 5'-Guanosine Monophosphate Aggregation: Stoichiometry, Modes of Specific Sodium Ion Complexation, and Binding to Ethidium

C. L. Marshall

Doctoral Dissertation, Michigan State University (1980)